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# Distribution of Plants with Extrafloral Nectaries and Ants at Two Elevations in Jamaica

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# Distribution of Plants with Extrafloral Nectaries and Ants at Two Elevations in Jamaica

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**Abstract**

Frequencies of plants with extrafloral nectaries were determined for two elevations in Jamaica. Extrafloral nectaries were found on 0.28 of the plants at sea level (Happy Grove, Portland) and 0.00 of the plants at 1310 m (Whitfield Hall, St. Thomas). Ant abundance, as indicated by discovery of and recruitment to baits, was greater at the lower elevation site. However, despite the apparent absence of plants with extrafloral nectaries, there were abundant ants at 1310 m.

Much evidence suggests that extrafloral nectaries attract insects which defend plants against herbivores and/or seed predators (Elias and Gelband 1975; Bentley 1976, 1977a, b; Keeler 1977). Extrafloral nectaries are glands which are located anywhere on a plant except those sites involved in pollination. These glands produce an aqueous solution containing sugars and other compounds (Baker and Baker 1975, Bentley 1977a, Keeler 1977). At present, only Bentley (1976) has studied the distribution of extrafloral nectaries in a natural habitat. She reported a positive correlation between frequency of plants with extrafloral nectaries and ant abundance in tropical dry forest in Guanacaste, Costa Rica. I report extrafloral nectary frequency and ant abundance from two sites in Jamaica.

Two sites were compared: Happy Grove, Portland, Jamaica (sea level, approximately 1700 mm annual rainfall, mean annual temperature 26°C, mean monthly temperatures 24-28°), and Whitfield Hall, near Hagley Gap, St. Thomas (1310 m up Blue Mountain, 3500 mm annual rainfall, mean annual temperature 22°C, mean monthly temperatures 16-32°). Since there are no weather records for the specific sites, values are extrapolated from U.S. Weather Bureau (1966) and Clarke (1974).

Significant human disturbance was seen at both sites. Studies were conducted close to trails used daily by local people. The transects at both sites ran from under the forest canopy (presumably second growth) out into partially open areas (early second growth at Happy Grove, coffee fields at Whitfield Hall).

Frequency of plants with extrafloral nectaries was determined in four transects at each site. At approximately every meter along each transect, plants were scored as having or lacking extrafloral nectaries and ants. The presence of extrafloral nectaries was determined by observing ants feeding in a stereotyped manner, and then locating the nectary. Once a species was determined to have extrafloral nectaries, it was scored as such on subsequent encounters. Ants were present at most extrafloral nectaries; of the 70 plants with extrafloral nectaries observed, only 10 (14%) did not have ants on them. The frequency of plants with extrafloral nectaries determined by this method is an underestimate, since some species may produce extrafloral nectar at other times of the year (e.g., fruit nectaries).

Ant abundances were estimated by using baits of canned corned beef and local commercial jelly. A pile of each food about 1 cm in diameter was placed on a separate piece of plastic, 25 $cm^2$, in the litter at each station. Time until arrival of the first ant, type of ant, peak number of ants responding and number of ant species attracted were recorded at each bait. Representative ants from baits at both sites and from foliar nectaries of plants at Happy Grove were collected. The experiments were carried out for three hours each, from 09:00-12:00 hrs in December 1977.

Results from the extrafloral nectary transects are given in Table 1. No species with extrafloral nectaries was observed at Whitfield Hall. At Happy Grove, 28 percent of the observed plants had extrafloral nectaries. These differences are statistically significant (T-test; $p << 0.001$).

Results of ant-baiting are given in Table 2. Bait-discovery time at Happy Grove (14.8 min) was one-third the discovery time observed at Whitfield Hall (49.6 min.) At Happy Grove, the total number of ants recruited was more than twice as great, and more species were seen than at Whitfield Hall. Both discovery time and total recruitment are statistically significantly different between Happy Grove and Whitfield Hall (Wilcoxon two-sample test, $0.025 > p > 0.01$ and $p = 0.005$, respectively).

Ants collected from baits at Happy Grove included *Paratrechina longicornis* (Latreille), *Solenopsis* sp. (not

**Table 1.** Frequency of plants with extrafloral nectaries.

| | Happy Grove (sea level) | Whitfield Hall (1310 m) |
|---|---|---|
| Number of plants with extrafloral nectaries | 70 | 0 |
| Number of points (all transects) | 248 | 233 |
| Mean frequency of extrafloral nectaries | 0.28[a] | 0.0[a] |

a. These values are statistically significantly different ($t_S$ = 12.29, arcsin transformation, $p$ << 0.001, Sokol and Rohlf, 1969).

**Table 2.** Ant baiting experiment results (duration: 3 hrs, 9-12 am).

| | Happy Grove (sea level) | | Whitfield Hall (1310 m) | |
|---|---|---|---|---|
| | mean | range | mean | range |
| Discovery time (min.) | 14.8[a] | 1–79 | 49.6[a] | 2–>180 |
| Percent of baits found | 100 | | .88 | |
| Ant species per site (mean) | 2.5 | | 0.9 | |
| Maximum number of ants recruited to a site | 184[b] | 100-270 | 67[b] | 0-270 |
| Total number of ant species seen | 6 | | 4 | |
| Number of baits | 14 | | 26 | |

a. These values are statistically significantly different 0.025 > $p$ > 0.01, using Wilcoxon two-sample test, US = 73 (Sokol and Rohlf, 1969).

b. These values are statistically significantly different, p = 0.005, using Wilcoxon two-sample test, $U_S$ = 78 (Sokol and Rohlf, 1969).

*S. geminata*), and *Tetramorium guineense* (F.); ants collected at Whitfield Hall were *P. longicornis*, *Crematogaster brevispinosa* Mayr., and *Monomorium floricola* (Jerdon). Ants collected from extrafloral nectaries at Happy Grove were *P. longicornis*, *Solenopsis* sp. (same as above), and *Wassmannia auropunctata* (Roger).

The number of ants on the foliage, determined from casual observations, was much greater at Happy Grove than at Whitfield Hall, where only *Crematogaster* sp. (presumably *brevispinosa*) were seen on the foliage.

Ant abundance has been suggested as an important factor in the distribution and effectiveness of extrafloral nectaries (Bentley 1977a and b). A positive correlation between extrafloral nectary abundance and ant response to baits was observed. Recruitment to baits is admittedly a crude way to measure the number of ants available for visiting extrafloral nectaries since baits may well evoke a greater response than do nectaries. No causal relationship between ant recruitment and frequency of extrafloral nectaries is suggested.

Compared to low elevations (200 m), Janzen et al. (1976) found that ants are absent from high elevations (3550 m), and present but in low numbers at intermediate elevations (1660 m). The decrease in ant response seen may be related to elevation. However, in Costa Rica, Carroll and Vandermeer (1972) reported that ant abundances did not change greatly along an elevational transect until 1785 m was reached, at which point a sharp decline in numbers was observed.

However, despite recruitment of ants to most baits, extrafloral nectaries are apparently absent at Whitfield Hall. Possible explanations for this observation include 1) baiting is a poor indicator of relevant ant abundances, 2) behavior of individual ant species, which was not recorded, is crucial, 3) ecological factors other than ant abundance are relevant.

Orians (1974) and Bentley (1977a) have stated that extrafloral nectaries are more common in tropical than temperate environments. Bentley (1976) reported the frequency of extrafloral nectaries at transect points to be 0.3 to 0.8 for dry forest and 0.1 to 0.4 for riparian forest in Guanacaste, Costa Rica. The value here reported for sea level (0.28) falls within that range, while the value of 0.0 for Whitfield Hall (1310 m) is lower. To my knowledge, there are no published distributional data for extrafloral nectaries from temperate regions. With a range of 0-0.8 from two studies, it appears that estimates of the frequency of extrafloral nectaries in tropical habitats deserve further investigation.

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